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ABSTRACT

Hypothesizing that experimentation with various teaching methodologies and individual student differences may show certain teaching methods to be more effective than others for a certain type of student, the authors studied the application of such experimentation to a portion of the radiology sequence in the dental curriculum. A review of the literature on the lecture method of instruction, the independent study method of instruction, and individual differences included findings in education and psychology, since studies generated by the health professions are not abundant. The study, in determining the effects of the two methods of instruction, the effects of personality (group dependency vs. self-sufficiency, need achievement), and the interaction effects between them, employed 134 first-year undergraduate dental students as subjects. They were administered a standard battery of psychological tests and were classified in the two personality groups and as high or low need achievers on the basis of the results. Achievement test score was the study's dependent variable. It was concluded that instructional methodology, personality type, and need achievement produced no significant differences in performance. Data were tabulated and presented in support of the conclusion. (A five-page bibliography and test forms for psychological tests and class tests are appended.) (AG)

12.07/INSTRUCTIONAL STRATEGIES RESEARCH (SYNOPSIS - DIVISION C)

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A COMPARISON BETWEEN LECTURE AND INDEPENDENT STUDY METHODS OF INSTRUCTION IN DENTAL RADIOLOGY WITH PROVISION FOR INDIVIDUAL DIFFERENCES

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Of the major problems that plague health professions education today, the manpower shortage, the knowledge explosion and the lack of qualified educators continue to head the list. Dental school administrators are now in the process of fighting a particularly extended and intractable battle: in the effort to turn the shortage of dental health manpower around, they find that extra numbers of qualified dental educators are required to present ever-increasing amounts of both basic science knowledge and clinical skills to expanded classes of dental students. And while dental administrators continue to hope for an eventual alleviation of the manpower shortage, a plateau in the knowledge explosion or an increase in the number of qualified teachers, the present realities only become more acute.

One manner in which these problems may be effectively handled today is through accelerated experimentation with various teaching methodologies and individual student differences. The results of such experimentation may show certain teaching methods to be more desirable than others for a particular type of student. These results could,

in turn, exact the most effective teaching even from a numerically-limited dental faculty, as well as offer a continuous flow of graduating dentists into the population. Moreover, students might be provided with the means by which ever-increasing amounts of knowledge could be learned, thereby freeing dental educators from the compulsion of having to "teach everything".

This study, then, represents the application of such experimentation in teaching methodologies and individual student differences to a portion of the radiology sequence in the dental curriculum. It is also an effort to combat the lockstep nature of a dental educational philosophy that still dictates a "middle-of-the-road" instructional approach to most of its students.

REVIEW OF RELATED LITERATURE

The supply of research studies generated by the health professions, particularly dentistry, concerning comparative teaching methodologies, is, at best, not abundant. Those studies that consider individual differences are virtually non-existant.

Therefore, the research findings of education and psychology will be reviewed in order to augment those of the health professions. This review will concentrate on the following areas:

A. the lecture method of instruction

B. the independent study method of instruction

C. individual differences

A. Lecture Method Of Instruction

Variations on the pure lecture, where a teacher talks to a group of students, are almost limitless. The popularity of these variations has therefore made pure examples of the lecture method of instruction increasingly difficult to find. Subtle combinations of the lecture with other modes, such as discussion, recitation, demonstration, laboratories and workshops has also made definitive statements about the nature of the lecture method equally difficult to formulate (Wallen and Travers, 1963).

The verbal instruction of the lecture hall, however, is an excellent example of what Ausubel (1963) and Wittrock (1963) have termed "expository teaching". As the teacher talks to the students for most of the time involved, he presents them with both the principles and solutions to problems that are to be learned. The stu-

dents need not make any independent discoveries. According to Ausubel (1963), the relative lack of research in expository teaching has been due primarily to an unfair identification with rote learning. Properly organized expository teaching, however, is capable of presenting a meaningful body of facts, concepts and principles which students can learn and transfer without resorting to rote memorization.

In a discussion of teaching at the college and university level, McKeachie (1963) maintains that the live lecture is of greatest value in transmitting knowledge where variation exists in learner motivation, ability and background i.e. individual differences. He argues that in the lecture situation, the teacher can, in turn, be flexible in his responses to student feedback. He is thus able to provide pertinent information at an optimum rate to students who may be too inexperienced to pace themselves. In spite of this advantage, however, the learner remains essentially passive within the instructional environment. On the other hand, Smith (1966) points to inherent teacher variability in live lecture instruction as being a drawback to the transmission of knowledge. Uncontrolled variations in his own quality and rate of delivery, motivation and temperament afford the teacher no special advantage over any other medium of instruction.

In addition, Wallen and Travers (1963) have analyzed teaching methods through relationships to six principles of learning. These six principles are based upon (a) cuing through advanced organizers, (b) active practice, (c) imitation of the teacher, (d) learner response, (e) learner self-pacing and (f) learner reinforcement. From the authors' observations, the lecture method of instruction is notably

deficient in cuing the learner, in allowing the learner to practice what is presented, in reinforcing the learner for a response and in allowing the learner to pace himself through the instructional process.

Formal research studies in education that have attempted to evaluate the effectiveness of the lecture method have most often used discussions and programmed instruction as comparison groups. The outstanding result in most of these studies has been one of non-significant differences (McKeachie, 1960; Silberman, 1962). Although Silberman feels that such results may very well be expected, one might as easily come to expect significant differences. This is because these comparisons involve teaching methods of extremely diverse composition, and may, therefore, have questionable validity. In addition, Silberman points out that the adverse effects of inadequate testing and control on the outcome of any of these studies is certainly great cause for concern.

Within the medical literature, three out of four research studies in teaching methods using the lecture as a comparison group report no significant differences. Allender et. al. (1965) compare achievement in internal medicine through lecture, textbook, programmed textbook and teaching machine approaches. Manning et. al. (1968) compare achievement in cardiography between lecture-discussion, lecture-workship, textbook and programmed textbook methods. A comparison of the lecture-recitation and audio-tutorial methods on achievement in veterinary radiographic anatomy has also been conducted by Welser et. al. (1970). The fourth research study reports an apparently unexpected significant difference in favor of a lecture group over a programmed instruction group. These results lead the authors (Elder et. al.,

1964) to consider the programmed instruction itself to be poorly constructed, indicating their expectation for a result favoring the programmed approach.

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Several informal observations and opinions from dental educators tend to be critical of the lecture method of instruction (Harrison, 1962, 1963; Podshadley, 1964; Young, 1969). An exception to this criticism are the comments of Durocher (1961, p. 78), who explains the potential virtues of the lecture method in the following way:

> "...the lack of motivation in many students has long been recognized. With the lecture as his tool, the influential personality of the teacher can set the stage for establishing the best attitudes of appreciation and for provoking a general enthusiasm... First-hand experiences, without guidance in correlation, can involve a considerable amount of excess learning activity devoted to arriving at the particular relationships... Of necessity the lecture must also to some degree substitute for other methods, since the student can not be exposed in school to every situation with which he is likely to be faced in the future. Again, the lecture method often offers the opportunity to present the class with just the bit of explanation or information needed to enable it to surmount a threatening barrier to learning..."

According to Durocher, much of the success of the lecture method is due to the dynamic influence of the teacher.

Several dental research studies in comparative teaching methods utilize the lecture as one of the comparison groups. In one of the studies, Podshadley (1964) describes a pilot project in which instruction in oral histology was presented to first-year dental students using lectures, programmed textbooks and seminars as the comparison groups. It was found that the lecture was just as effective a method for learning the subject material as was the programmed textbook or seminar. In another of the studies, McCrea and Swanson (1969) compare performances in oral histology and embryology for two first-year dental classes. One class was taught under the lecture-laboratory

method. The subsequent class received programmed instruction, but with some lectures still included. Although the group receiving programmed instruction is stated to have performed far better than the lecture group, significance levels for justifying such a conclusion are not supplied. Certainly, the contamination of the programmed instruction group with additional lectures compromises the study's validity.

Although it appears to meet very few of the demands of learning principles, the lecture has frequently been found to be just as effective a teaching method as other methods used in comparative research. A large portion of the lecture's effectiveness is undoubtedly a direct result of the teacher's influential participation and charisma. Unfortunately, such variables become difficult to control in any comparative teaching methods study.

B. Independent Study Method Of Instruction

The concept of the independent study method of instruction has been variously known as self-selected study, self-instruction, self-paced instruction, self-centered instruction, student-controlled instruction, individualized instruction and audio-tutorial instruction. These different terms reflect the wide range of thought that exists concerning the nature of independent study. The two-fold result has been confusion in identification of independent study programs and the subsequent lack of a standarized definition.

Lonnon and Bodine (1971) point out that the independent study has unfortunately become so all-encompassing that it now includes any educational activity outside of formal classroom instruction.

What independence, and therefore, independent study, really implies is the opportunity to think and act with a minimum of outside influence i.e. the teacher. The authors' concept of an independent study program embraces three main features:

1. all student work is self-assumed i.e. independence can not develop if assignments (or objectives) are given and enforced.
2. students must evaluate themselves.
3. the student must be able to schedule his own time and activities.

In discussing four types of individualized instruction, Edling (1970) attributes the greatest degree of student freedom to independent study. Here also, students are able to choose their own instructional objectives as well as the study methods for achieving those objectives. With the three other types of individualized instruction (individually prescribed instruction, self-direction, personalization), objectives, the methods for their achievement or both are predetermined.

Wallen and Travers (1963), however, refer to independent study as a "project method", in which a student fulfills the requirements of a definite assignment by himself, with teacher assistance only when necessary. In commenting on the relationships between their six stated principles of learning and modern teaching methods (in which the independent study or project methods can be assumed to belong), the authors feel that such teaching methods can provide for ample amounts of cuing, self-pacing, learner practive, response and reinforcement. They also emphasize the nonsignificant differences that have generally resulted from the limited number of studies that

have compared the project method with various forms of the lecture method. Along with Cox and Vargas (1966), they point to the inadequacies of normative measurement systems that rank students participating in independent study according to their different levels of achievement rather than the criterion mastery of specific content. All learners in an independent study situation should be completing instructional objectives to the same predetermined level of mastery, thereby avoiding the need to rank order the achievements of individuals.

A description of independent study in secondary teacher education at Brigham Young University by Baird et. al. (1971) mentions that research in teaching and learning has provided essential teacher behaviors from which a list of specific behavioral objectives are written by the authors. The objectives culminate in learning experiences which are then presented to the students. Pre-tests and post-tests are administered by the authors rather than utilizing self-evaluation. Each student is responsible for scheduling his own activities.

Postlethwait (1971) presents independent study in biology and botany-zoology (Postlethwait, Novak, Murray; 1972) within the framework of his now-famous Audio-Tutorial System, in which his students are involved in a full range of laboratory learning experiences. He asserts that both teacher and student should be concerned with those activities contributing to learning. However, it is the teacher's obligation to provide the course structure for these activities. Conversely, the student is equally obligated to perform these activities. Although comprehensive quiz sessions are scheduled, the students are able to evaluate many of their own learning activities as they proceed through the course.

Postlethwait maintains that the strength of his Audio-Tutorial System as a learner-controlled instructional environment rests on the following points:

1. repetition is student-regulated
2. concentration is promoted through physical isolation
3. all learning materials are constantly available
4. pace is student-regulated
5. appropriate media are adapted to objectives
6. multi-media are available to promote the best learning
7. all learning activities are sequentially integrated

Tuckman's (1971, p. 10) conception of independent study is one of a student-centered curriculum whose implementation will require extensive philosophical and functional changes in education.

> "...The student-centered curriculum would appear of necessity to require a non-graded school. It would do away with the traditional concept of ability grouping and tracking as it is presently practiced in most American secondary schools. It would require modular scheduling of the finest degree and it would require a computer system for record keeping and sequence coordination..."
>
> "...A student-centered curriculum will make great use of multiple instructional strategies, allowing students to learn through interaction with their environment, utilizing all sensory modalities. Visual aids, as well as participation aids of all sorts, will be utilized..."
>
> "...Teachers would have to be trained to function out of a framework other than the traditional subject matter framework, and to play a role in the classroom which is different from the instructional role the teacher presently plays. Rather than being the provider of information, the teacher will function within a student-centered curriculum as a guide and interactor..."

Rovin (1973) has pointed out that the art of teaching is most effectively realized when the teacher is able to determine objectives

and develop materials, rather than act as a communication device. In redefining the role of the teacher, Lonnon and Bodine (1971) suggest specific "behavioral shifts" required of the teacher:

1. from "fountain of knowledge" to "consultant"
2. from "director of learning" to "resource person"
3. from "pacer of learning" to "manager of learning resources"
4. from "enforcer of coverage" to "assistant in student self-evaluation.

Over-all, Gagné (1971) maintains that student learning itself can and does take place without the presence of the teacher; the learner, he says, is the only essential part of an educational system. In addition, he presents six hypotheses about conditions that may promote learning when the instructional environment is controlled by the learner:

1. The student needs to learn, as a general principle, that learning takes place inside his head, as a result of his own "thinking" activity.
2. Outlines, indexes, reference lists, and other materials or devices need to be designed for maximum ease and efficiency of employment by the student in finding the stimuli ("learning materials") he needs.
3. Concepts and principles to be learned must be communicated in a manner which is optimally effective. In many instances, this will be done by means of textbooks; and it is not known that these are designed as well as they might be for this purpose. Audio and visual modes of communication also need attention in this respect.
4. Every stage of learning should begin with a statement that makes the objectives of learning clear to the learner. Such a statement probably also needs to remain readily available to the learner throughout a "lesson" or other unit to be learned.
5. A means of appraisal should be provided to the learner which bears a direct and obvious relationship to the objectives

of learning. By this means, the learner can check his own performance and obtain immediate feedback.

6. Opportunities need to be provided for two activities of importance to the transfer of learning. The first of these is discussion of what has been recently learned with other people, whether teachers or students, for the purpose of refining, sharpening, and embellishing the mediatorial processes that have been acquired. The second is the application of the acquired knowledge in specific practical situations. (p. 26-27)

In support of Gagné, several studies (Milton, 1959, 1962; Caro, 1962) report that students who studied introductory psychology on an independent basis performed as well or better than those who attended a formal class. Caro (1962) also notes that the number of students who sought individual assistance was unrelated to either of the experimental teaching methods (lecture-discussion vs. independent study).

Several descriptions of implementations of Postlethwait's Audio-Tutorial System for independent study within health professions environments have recently been reported. Peterson (1970) describes a pilot study in which multisensory tutorial (audiotapes, slides, etc.) learning packages were designed to teach Maslow's theory of basic need hierarchies to student nurses (St. Mary's Junior College, Minneapolis, Minnesota). The results of comparisons between the pilot study group and a peer group that learned via the traditional approach are not yet available.

Mentzer (1971) reports on the hospital audio-tutorial "laboratory" (Washington Hospital School of Nursing, Washington, Pennsylvania) that presents instruction in the life sciences to student nurses. In addition to tape recorders, slide projectors and film loop projectors, other pieces of equipment specific to laboratory exercises such as bunsen

burners, microscopes, kymographs, spirometers and oscilloscopes are utilized within this system. Although student interest and acceptance has been excellent, no evaluative data is as yet available concerning studies comparing this method of teaching life sciences with any other method.

Moreland (1972) describes a fifty carrel, multi-media independent learning center for presenting basic science concepts and clinical techniques to dental students (School of Dentistry, University of Maryland). Evaluative data is not available at this time.

Nash (1972) describes a 30-hour course in growth and development taught to second year dental students (School of Dentistry, Louisiana State University) via the audio-tutorial format. He mentions that although student opinion has been mixed, the overall reaction has been favorable, justifying continuing efforts in this area.

Two recent research studies from the dental literature employ self-instruction as an alternative teaching method. Deneky (1973) randomly assigned fifty-six (56) freshman dental students into an experimental group using an audio-visual teaching machine and a lecture control group. The subject material covered the preparation, placement and finishing of gold restorations. The study was designed to control for method of presentation, stimulus-response and reinforcement. Evaluation of the students was made on both cognitive and psychomotor skill levels. A comparison of the two groups on a written examination showed a significant difference in favor of the experimental group. The practical examination scores, however, showed no significant differences between the experimental and control groups.

Kopczyk et. al. (1973) described the evaluation of a self-instructional "mini-course" in periodontal suturing. Fifty-one (51) sophomore dental students were stratified into three levels by grade-point average and then randomly assigned to the experimental group (self-instruction) or the control groups (lecture, laboratory-seminar). Evaluation consisted of written pre-tests and post-tests and a two-week follow-up practical examination for retention of technique. It was found that the grade-point standing did not influence post-test scores. Self-instruction was found to be significantly better than the laboratory-seminar. There were no significant differences between self-instruction and the lecture; or between the laboratory-seminar and the lecture. There were no significant differences among any of the groups on the practical examination. Both the lecture and laboratory-seminar required fifty minutes presentation time. Time needed for the self-instructional "mini-course" varied from thirty-four to sixty minutes and averaged forty-five minutes.

Whatever format an independent study-instructional method may take, its use, then, is justified by at least one theoritical consideration: "learning" occurs within the learner only, despite any outside influences. In addition, independent study may also possess an increased capability for satisfying certain learning principles. The independent study method of instruction has almost always been found to be just as effective a teaching method as others used in comparative research. Because of the self-pacing component, it is frequently more efficient. Implementation of independent study on any scale implies reconsideration and redefinition of traditional teacher functions.

C. Individual Differences

Glaser (1972) has made the distinction between selective and adaptive education. Selective education is that in which minimal variations in student learning conditions exist i.e. a narrow range of instructional options are available. The adaptability of the system to the student is limited, and, therefore, particular abilities on the part of the student are required for success. In fact, the success of the system itself is predicated on the selection of students possessing those necessary abilities. Adaptive education, on the other hand, features a system in which alternate means of learning are adapted to and matched to each individual. Thus, a definite interaction comes to exist between performance and the educational setting. Methods of adapting education to individual differences are summarized by Cronbach (p. 140, 1971) in Table I. Glaser feels that the typical adaptive educational environment possesses the following characteristics:

1. the teaching of self-management skills and the design of educational settings to foster the acquisition of learning skills.
2. the teaching of basic psychological processes.
3. the design of flexible curricula with different entry points, methods and options.
4. an emphasis on open testing and behaviorally indexed assessment.

With the implementation of adaptive education, the use of terms such as "poorly motivated student" and "inadequate aptitude level"

TABLE I

PATTERNS OF EDUCATIONAL ADAPTATION TO INDIVIDUAL DIFFERENCES

Educational Goals	Instructional Treatment	Possible Modifications To Meet Individual Needs
Fixed	Fixed	1a. Alter duration of schooling by sequential selection.
		1b. Train to criterion on any skill or topic, hence alter duration of instruction.
Options	Fixed within an option	2a. Determine for each student his prospective adult role and provide a curriculum preparing for that role.
Fixed within a course or program	Alternatives provided	3a. Provide remedial adjuncts to fixed "main track" instruction.
		3b. Teach different pupils by different methods.

is neither adequate nor justified in explaining substandard performances. According to Glaser (1972), for accommodation of true individual differences to take place, there is a need to identify what the relevant differences within pre-instructional behaviors are, in order to discover why one student learns and another doesn't. The usual tests of general ability, aptitude and intelligence predict the outcomes of learning. However, these tests do not measure the variables that are related to different ways of learning--the different ways in which students learn best:

> "...The traditional measures of general ability and aptitudes err on the side of assuming too much consistency, and de-emphasize the capabilities of individuals to devise plans and actions depending upon the rules, needs, and demands of alternative situations. If, in our thinking about individual differences, we make as much room for the capability of individuals to adapt and change, as well as to be stable, and as much room for the capacity for self-regulation and self-development, as well as for victimization by enduring traits, then an adaptive notion of education must follow..." (1972, p. 11)

In searching for these variables, Glaser (1972) strongly suggests that cognitive styles and processes as well as personality differences of learners be given consideration. Messick (1972) has defined a cognitive style as an information processing habit, representing modes of perceiving, remembering, thinking, and problem-solving. Cronbach and Snow (1969) feel that personality characteristics are very influential in the adaptation of the educational system to the individual, rather than the individual to the system. They foresee that any objections to the use of such characteristics will diminish when the characteristics are used as a basis for choosing treatments instead of selecting or rejecting students.

Glaser (1971) has pointed out that, thanks to research in programmed instruction, rate of learning has come to be the most prominent variable in the consideration of individual differences. Cronbach (1971), Cronbach and Snow (1969), and Gagné and Paradise (1961) have hypothesized, however, that the entire concept of "learning rate" is really a false one. Rather than being fixed, a person's learning rate varies, depending on the instructional situation.

In fact, individual differences in rate of learning may really be due to:

1. the number and kinds of learning sets (competencies, knowledge) brought to the situation,
2. student standing in respect to certain basic abilities relevant to those competencies,
3. the level of general intelligence,

rather than any individual variation in the general ability to learn fast. It is felt, therefore, that the adaptation of instructional techniques will be more meaningful than the alteration of the duration of exposure to the learning situation in order to determine learning rate. Gropper and Kress (1965) have also discussed the fact that self-pacing by the learner may not be a panacea for slow learning. Certain learners need to be speeded up and others need to be slowed down so that the effectiveness and efficiency of learning is improved.

Cronbach and Snow (1969) define an aptitude as any characteristic of an individual that increases or impairs his probability of succeeding within a given treatment. Cronbach and Gleser (1965) have indicated that information about aptitudes is useful in treatment adaptation

only when an interaction can be demonstrated between the aptitude and the treatment. They explain it as follows:

> "...Given a measure of aptitude, and two different instructional methods, if the aptitude measure correlates positively with success in both treatments, then it is of no value in deciding which method to suggest to the student...What is required is a measure of aptitude that predicts who will learn better from one curriculum method of learning than from another..." (p. 8)

According to them, the poorer the differential aptitude information that is available, the less the teacher should depart from treatments that work best for students on the average.

Messick (1971, p. 145), in formulating a kind of rationale for interaction studies, has also commented on the futility of treatment comparisons without consideration for individual differences:

> Consider the kind of "horse race" question typical of much educational research of past decades: Is textbook A better than textbook B? Is teacher A better than teacher B? Or, more generally, is treatment A better than treatment B? Such questions are usually resolved empirically by comparing average gains in specific achievement for students receiving treatment A with average gains for students receiving treatment B. But suppose treatment A is better for certain kinds of students and treatment B better for other kinds of students. Depending upon the mix of students in the two groups, the two treatments might exhibit negligible differences on the average when they actually produce widely different effects upon individuals. A completely different evaluation of the treatments might have resulted if some other questions had been asked, such as "Do these treatments interact with personality and cognitive characteristics of the students or with factors in their educational history or family background to produce differential effects upon achievement? Do certain student characteristics correlate with gains in achievement differently in one treatment than in the other?"

The investigation of interactions between treatments and aptitude variables has been called the Aptitude-Treatment Interaction problem or ATI (Bracht, 1970; Cronbach and Snow, 1969; Glaser, 1972). More

recently, the term Trait-Treatment Interaction (TTI) has been used to convey the same meaning (Berliner and Cahen, 1973). In this type of work, emphasis is placed on predicting appropriate learning methods for individuals possessing certain aptitudes, in order to attain similar educational outcomes. If there were several options within any educational program, then such interaction patterns might predict the particular option in which a student could expect the most success. Cronbach (1971) has suggested that the experimental method of choice for uncovering interactions would be to take promising differential variables and design alternative treatments to interact with those variables. Such variables might be those that have been most often drawn from factor analysis.

Lublin (1961) and Berliner and Cahen (1973) have used the concepts of "ordinal" and "disordinal" to further describe the interactive process. The concepts may be understood by referring to Table II (Berliner and Cahen, p. 60, 1973) which illustrates, by way of regression lines, the three types of interaction as they relate to a single trait or aptitude, two different treatments and a single performance measure.

Figure II A represents no interaction between trait and treatment. The mean outcome for treatment 2 is always greater than for treatment 1, regardless of the trait level. On this basis, all students should be assigned to treatment 2.

The ordinal interaction pictured in Figure II B also shows that treatment 2 is superior to treatment 1 at all trait levels. Although the regression lines are not parallel, they do not cross within the observed range of the trait measure. Differences in treatment out-

TABLE II

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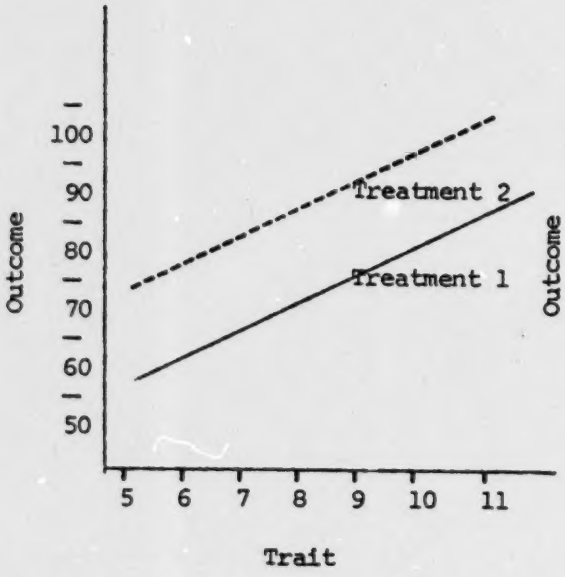

Figure II A
No interaction between trait and treatment.

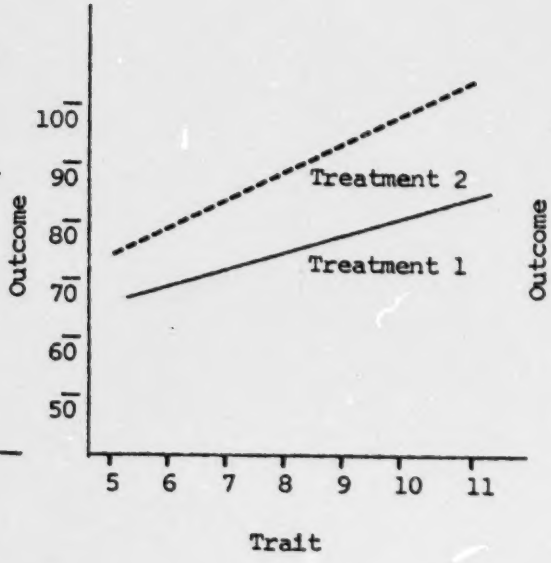

Figure II B
Ordinal trait-treatment interaction

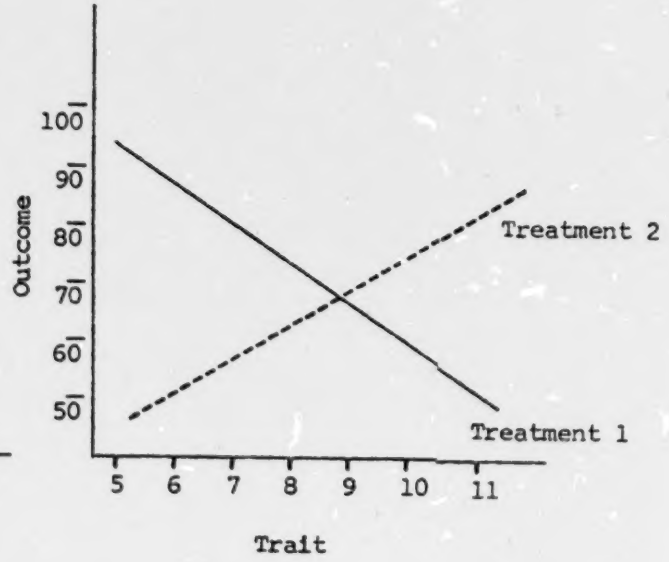

Figure II C
Disordinal trait-treatment interaction

comes at the lower end of the trait scale are not very large. Therefore, all learners might again be assigned to treatment 2 if the cost of both treatments are about equal, or to treatment 1 if its cost is considerably less.

Disordinal interaction is illustrated in Figure II C. Here, the regression lines actually do cross within the observed range of the measured trait. According to this example, students with trait values below 9 receive more benefit from treatment 1. Those students with trait values above 9 benefit more from treatment 2. Both treatments provide for equal benefit for students with a trait value of 9.

Briggs et. al. (1967) envisioned complex, multiple interaction studies in which personality variables, learning conditions, specific features of programming and types of media would be considered together.

Cronbach (1971) states that the most thoroughly-documented interactions involve risk-taking behavior, and confidence and motivation toward self-directed achievement. He cites several studies (Grimes and Allinsmith, 1961; Atkinson and O'Connor, 1963; Kogan and Wallach, 1964) supporting the hypothesis that defensively motivated students will learn the most under conditions that maximize dependence (constant feedback, maximum of explanation and guidance, detailed, short-term goals), and that constructively motivated students will learn the most under discovery-like conditions (learning to judge for oneself, intermittent feedback on difficult tasks, long-range goals).

Using the 16 Personality Factor Questionnaire, Brucker (1970) considered the effects of anxiety and permeability variables on achievement in a teacher education curriculum for senior college students.

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It was found that students expressing high anxiety produced lower immediate achievement overall, achieved significantly less in enclosed environments, and had a less favorable opinion to individualized instruction than students expressing low anxiety.

Koenig and McKeachie (1959) conducted a study to investigate the interactions produced between teaching methods (small group discussion, independent study, lecture-discussion) and personality characteristics (self-reliance, need affiliation, need achievement) for 89 females and 35 males in an introductory psychology course. Stott's Everyday Life Inventory and the Thematic Apperception Test (modified by McClelland) were used to measure self-reliance and the needs of affiliation and achievement, respectively. The major findings were:

1. that self-reliance and need affiliation are unrelated to satisfaction, performance and involvement in small group discussions and independent study.
2. that women expressing high need achievement prefer the two innovative teaching methods to the lecture method; women expressing moderate need achievement prefer the lecture method.

The authors conclude that:

> "...students with certain types of personality should not be excluded from independent study or small group discussions. As we see it, our goal should be for all students to learn to work independently and to participate responsibly in small groups. Rather than excluding students who dislike independence or work in small groups from these classes, we may want to give them special training and attention in order to help them learn how to learn in these situations. Increased knowledge about student personalities should give us increased ability to achieve these goals." (p. 134)

Lublin (1965) showed, interestingly enough, that in a programmed introductory psychology course, subjects expressing low autonomy need scored significantly higher on a criterion test than did subjects expressing high autonomy need. The classroom situation, however, was not totally an independent one: three classes were held each week with instructions given on how to proceed; the experimenter decided on the amount of class material to be covered at each session; all subjects were required to be at the same place within course content; all subjects began and finished course material on the same date. Lublin explained her results, then, in terms of frustrated subjects with high autonomy needs, unable to function well in what turned out to be a relatively structured environment.

Using the Guilford-Zimmerman Temperament Survey, Haskell (197C) has demonstrated that programmed instruction was a more effective teaching method than conventional instruction for students expressing high friendliness and low general activity. Although he found no significant differences for main effects of programmed instruction and conventional instruction on achievement test scores, Haskell concluded that the effectiveness of a teaching method varies as a function of certain personality characteristics - in this case friendliness and general activity.

Doty and Doty (1964), in attempting to relate the effectiveness of programmed instruction to cumulative GPA, creativity, need achievement, social need and attitude toward programmed instruction, demonstrated non-significant correlations between achievement in programmed instruction and both achievement need and attitude toward programmed instruction.

The studies of Briggs et. al. (1955) and Silverman and Alter (1961) resulted in no significant differences in programmed instruction learning between experimenter-paced and student-paced teaching methods. Follettie (1961), however, has shown self-pacing to be superior to forced-pacing on measures of training time, testing time, and test scores.

In projecting toward the future, Glaser (1971) cautions that although new learning environments can change developmental student norms, there are limitations to such change. Certainly, these limitations must be considered after having adjusted an entire learning environment to pre-instructional capabilities and characteristics. Both Glaser (1971) and Briggs et. al. (1966) are interested in the type of interface that might exist between the student and the subject matter in these new environments. That fact that different learners require different stimuli indicates that a multi-media approach to learning should be considered, in order to maximize student manipulation of the subject matter for an enriched learning environment.

STATEMENT OF THE PROBLEM

Several research studies in the review of related literature have indicated the potential for using student personality variables in determining the most effective instructional method for a given situation. The dental educational literature lacks information on such an approach to instructional methodology.

The basic problem of this study, then, is to determine the effects of the lecture and independent study methods of instruction, the effects of personality (group dependency vs. self-sufficiency, need achievement) and the interaction effects between instructional method and personality on achievement in interpretive dental radiology.

METHODOLOGY

A. Subjects

The subjects participating in this research study were drawn from a population of 134 first-year undergraduate dental students of the School of Dental Medicine, University of Pittsburgh (Class of 1976). Those participants demonstrating advanced status (graduate education in radiology, radiographic technician, etc.) from admissions records or those repeating the first year were eliminated from the study.

B. Instrumentation

Immediately after their entrance into the first year class, all students were administered a standard battery of psychological tests by the guidance counsellor of the School of Dental Medicine. The following tests were included:

1. 16 Personality Factor Questionnaire. (Cattell and Stice, 1957)

   The 16 Personality Factor Questionnaire (16 P.F.Q.) consists of 293 multiple choice items presented in three forms: A, B and C. Instead of administering all 293 items, however, only those items dealing with Factor Q2, group-dependency vs. self-sufficiency, were used to initially classify students. Thus a total of 26 items (10, 10 and 6) were covered over the three forms (See Appendix A). Cattell and Stice (1957) comment on Factor Q2 as follows:

> "...It is one of the major factors in introversion. The items show a person who is resolute and accustomed to making his own decisions, alone, while at the Q2- pole we see a person who goes with the group, definitely values social approval more, and is conventional and fashionable. Occupationally, $Q2^+$ is very high for executives, scientists--and criminals! In group dynamics the high $Q2^+$ person is significantly more dissatisfied with group integration, makes remarks which are frequently solutions than questions, and tends to be rejected. At school $Q2^+$ children prove commonly to have been decidedly on the seclusive side--early developers who tend to associate with a few older friends." (p. 18)

2. Edwards Personality Preference Schedule (Edwards, 1959)

The Edwards Personality Preference Schedule (EPPS) consists of 225 forced-choice items that measure 15 personality variables. After administration of the entire test, only the results of the 28 items that are used to measure the manifest variable of need achievement (ACH) were considered (See Appendix B). These results were used to classify students as high or low need achievers for comparison purposes later in the study. Edwards (1959) defines the variable of need achievement this way:

> "To do one's best, to be successful, to accomplish tasks requiring skill and effort, to be a recognized authority, to accomplish something of great significance, to do a difficult job well, to solve difficult problems and puzzles, to be able to things better than others, to write a great novel or play." (p. 11)

C. Experimental Procedures

Students were classified as group-dependent or self-sufficient on the basis of the results of the Factor Q2 portion of the 16 P.F.Q. This was accomplished by rank ordering the scores and selecting

and extreme number (52) from both ends of the rank order. 34 students of each type were then randomly selected from the students so classified. Both types were then randomly assigned to the two experimental treatment groups.

In addition, classification of all students as high or low need achievers was made on the basis of the results of the ACH portion of the EPPS. These scores were also rank ordered, but the so-called extreme scores selected in this instance were those above and below the median.

The major independent variable in this study is instructional method. (Personality characteristics as determined by 16 P.F.Q. and ACH are considered to be "assigned" independent variables). The two instructional methods employed were the lecture method and the independent study method.

1. Lecture Method Group (X_1)

   All of the students in this group (34) attended eleven (11) one-hour lectures of interpretive dental radiology. The scope and depth of subject matter content varied little between this course and that of the previous year. Also, every lecture contained a number of x-ray slide presentations (See Appendix C). When attending these lectures each student brought an assigned textbook. For purposes of uniformity, the students in this group received the same general and specific written objectives for each lecture as those students in the independent study method group (See Appendix D). Since atten-

dance was always taken, it was expected that students would be present at lectures, raise questions consistent with available lecture time and take various lecture notes. They were free to consult with an instructor when they wished to do so. As in previous years, one instructor was responsible for eight of the eleven lectures presented. (See Appendix E).

2. Independent Study Method Group (X_2)

All of the students in this group (34) were presented with the same quality of subject material content as group X_1, i.e. there were no deletions or substitutions of any concepts to be learned. Quantitatively, however, the content varied, since more definitive sequencing of the material often resulted in lessons that were not equivalent in length to the one-hour lectures. The same written objectives distributed to group X_1, were also given to group X_2.

Students were able to proceed with a lesson at whatever speed was comfortable for them. They could not advance to the next lesson without completing the previous lesson. They might, however, study any lesson as often as they liked. Students in this group were also free to consult with an instructor if they wished to do so.

The Independent Study Learning Center was located within the School of Dental Medicine, University of Pittsburgh and was utilized exclusively by students in treatment

group X_2. The Center was available Monday through Friday, 8:30 A.M. to 6:00 P.M. and Saturday mornings for the entire Winter Term of 1972-73. Appointments for the utilization of the Center's facilities were necessary since equipment was secured when not in use. The physical appearance and integration of learning experiences within the Center reflected a basic audio-tutorial systems approach to independent study. After obtaining appropriate lesson objectives, students were able to receive instruction from cassette tapes, radiographic slides and textbook assignments. The students participated in three self-evaluation quizzes during their instruction which helped them in determining their progress throughout the course. These quizzes were not graded. (See Appendix F).

D. Performance Measures

The dependent variable in this study is achievement test score. Traditionally, achievement tests in interpretive dental radiology at the School of Dental Medicine have been composed of multiple choice test items and x-ray slide identification items. These tests have been administered soon after the completion of the course as so-called "Unit Tests". They have also been administered as part of a larger "Comprehensive Examination" several weeks after course completion. Occasionally, both a Unit Test and Comprehensive Examination are offered.

It was decided that, for purposes of this study, the same type of test item format would be used. A different approach to the temporal aspect of test administration was necessary, however, because of the nature of the treatment groups. Early in the study it was recognized

that complete individuality of testing for Group X_2 would be unfeasible i.e. 34 similar tests would be extremely difficult to construct and administer. It was still necessary to provide for individual rates of progress while facilitating the mechanics of testing within the more general constraints of the dental curriculum.

Therefore, three Unit Test Periods were designated in which similar forms of the traditional type of test were offered. Each test included 20 multiple choice test items and 40 x-ray slide identification items (See Appendix G). The first Unit Test Period coincided with the end of the lecture course. Although primarily intended for students of Group X_1, any student from Group X_2 who felt sufficiently prepared could take the test at that time. The other two testing periods were intended exclusively for students of Group X_2. These test administrations were 10 days and 38 days after the first test session, respectively (See Appendix H).

10 days after the third Unit Test Period, 20 x-ray slide identification items were administered to the entire class as a portion of a larger Comprehensive Examination that included test items from other disciplines. This Examination could be thought of as a kind of retention test (See Appendix I).

E. Hypotheses

1. There will be no significant differences in achievement test scores between the lecture method group (X_1) and the independent study method group (X_2).

2. There will be no significant differences in achievement test scores between group-dependent students and self-sufficient students.

3. There will be no significant differences in achievement test scores between high need achieving students and low need achieving students.

4. There will be significant interactions on achievement test scores between instructional methods and the personality variable of group-dependency vs. self-sufficiency (Factor Q2).

5. There will be significant interactions on achievement test scores between instructional methods and the personality variable of need achievement (ACH).

F. Experimental Design

The procedure used for this study was constructed around a modified Post Test Only Control Group Design (Campbell and Stanley, 1963), and is, therefore, classified as a true experiment. Rather than comparing a group that receives no treatment at all (control) to one that does, both groups in this study received definite yet different treatments. Again, the designations of X_1 (lecture method group) and X_2 (independent study method group) were used.

$$R\ X_1\ O$$
$$R\ X_2\ O$$

The design was implemented through 2 x 2 factorial approaches to analysis of variance that were essentially multivariate in nature (See Table III, p. 34).

TABLE III

EXPERIMENTAL DESIGN

		INSTRUCTIONAL METHOD	
		LECTURE (L)	INDEPENDENT STUDY (IS)
PERSONALITY	SELF-SUFFICIENT (S)	SL	SIS
	GROUP-DEPENDENT (G)	GL	GIS

Figure III A. 2 x 2 factorial design for interactions of instructional method and Factor Q2 on achievement test scores.

		INSTRUCTIONAL METHOD	
		LECTURE (L)	INDEPENDENT STUDY (IS)
NEED ACHIEVEMENT	HIGH (H)	HL	HIS
	LOW (L)	LL	LIS

Figure III B. 2 x 2 factorial design for interactions of instructional method and need achievement (ACH) on achievement test scores.

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STATISTICAL ANALYSIS

Scores from the achievement tests, the comprehensive examination and the personality scales were transferred from IBM scoring sheets and coded onto key punch cards. The information from these cards provided the input for NYBMUL, a computer program of univariate and multivariate analysis of variance (Finn, 1972). Included in the output were:

1) Univariate F-ratios for both the main effects of treatment (instructional method) and personality variable (group-dependency vs. self-sufficiency; need achievement) on achievement scores in the Unit Test and Comprehensive Examination.

2) Univariate F-ratios for the interaction effects between treatments and personality variables on achievement scores in the Unit Test and Comprehensive Examination.

3) Multivariate F-ratios for the test of equality of mean vectors for both main effects and interaction effects.

A total of six analyses were performed, one for each level of the two independent variables, and their two-way interactions for the Unit Test and the Comprehensive Examination.

RESULTS

A. General

Observed and over-all total means for each of the eight cells for the Unit Test and the Comprehensive Examination appear in Table IV (p. 37). Summary MANOVA tables for univariate and multivariate main effects and interaction effects appear in Tables V through VII (pp. 39 to 41). Interaction grids illustrating the effects of Treatment X Factor Q2 and Treatment X ACH on both Unit Test and Comprehensive Examination appear in Tables VIII and IX (pp. 42 and 43).

B. Interpretation

1. Main Effects of Treatment (Instructional Method)

Table V provides a summary of the MANOVA outcomes for the Unit Test and Comprehensive Examination. F-ratios for the Unit Test indicate that treatment conditions produced no significant differences in performance. An inspection of the F-ratios for the Comprehensive Examination, however, does reveal significant differences in performance as produced by treatment conditions in both factorial designs ($F=3.9669$, $p<.05$; $F=4.0540$, $p.<.05$). Students in the independent study method group scored higher than their lecture method counterparts (14.17 vs. 13.29; 14.17 vs. 13.27). There was a tendency for over-all performance to differ between the treatment conditions in both factorial designs. However, those differences ($F=2.8151$, $p.<.0675$; $F=2.7769$, $p.<.0699$) were not significant at the .05 level.

2. Main Effects of Factor Q2

Figure A of Table VI reveals a tendency for performance

TABLE IV

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Factor Q2		TREATMENT: Lecture Method	TREATMENT: Independent Study Method	Over-All
Self-Sufficient	$\bar{X}_u$•	50.94 (17)+	48.17 (17)	49.55
	$\bar{X}_c$••	13.64 (17)	14.52 (17)	14.08
Group-Dependent	$\bar{X}_u$	49.76 (17)	51.35 (17)	50.55
	$\bar{X}_c$	12.94 (17)	13.82 (17)	13.38
Over-All	$\bar{X}_u$	50.35	49.76	
	$\bar{X}_c$	13.29	14.17	

• Mean Unit Test Achievement Score

•• Mean Comprehensive Examination Achievement Score

+ Cell Number

Figure A. Summary of means for 2 x 2 factorial (treatment X Factor Q2)

Need Achievement (ACA)		TREATMENT: Lecture Method	TREATMENT: Independent Study Method	Over-All
High	$\bar{X}_u$	49.88 (18)	51.06 (16)	50.47
	$\bar{X}_c$	13.66 (18)	14.06 (16)	13.86
Low	$\bar{X}_u$	50.87 (16)	48.61 (18)	49.72
	$\bar{X}_c$	12.87 (16)	14.27 (18)	13.57
Over-All	$\bar{X}_u$	50.38	49.84	
	$\bar{X}_c$	13.27	14.17	

Figure B. Summary of means for 2 x 2 factorial (treatment X ACH)

on the Comprehensive Examination as well as over-all performance to differ between the two levels of Factor Q2, group-dependency vs. self-sufficiency. Those differences ($F=2.5388$, $p.<.12$; $F=2.4482$, $p.<.0947$), however, were not significant at the .05 level.

3. Main Effects of ACH

Figure B of Table VI indicates quite clearly that the personality variable of need achievement produced no significant differences on either of the two performance measures or on over-all performance.

4. Interaction Effects

Interaction analysis for Treatment X Factor Q2 and Treatment X ACH is shown in Table VII. There was a tendency for treatment conditions and Factor Q2 to significantly interact on performance outcome in the Unit Test ($F= 3.7015$, $p<.05$). This univariate interaction is illustrated in the grid of Figure VIIIA, Table VIII, in which a disordinal interaction is represented. All other univariate interactions were non-significant. There was a tendency toward multivariate interaction between treatment conditions and need achievement on over-all performance measures. That interaction ($F=2.6324$, $p<.0799$) was not significant, however, at the .05 level. The multivariate interaction between treatment conditions and the personality variable of group-dependency vs. self-sufficiency on over-all performance measures was non-significant.

TABLE V

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Dependent Variable	df	Mean Square	Univariate F	Probability
Unit Test	1	5.8824	0.2704	<.60
Comprehensive Examination	1	13.2353	3.9669	<.05
F-Ratio For Test Of Equality Of Mean Vectors	2 and 63		2.8151 (Multivariate) F	<.0675

Figure A. Summary MANOVA Table: Main effects of treatment in the 2 x 2 factorial, Treatment X Factor Q2.

Dependent Variable	df	Mean Square	Univariate F	Probability
Unit Test	1	5.0345	0.2252	<.60
Comprehensive Examination	1	13.7012	4.0540	<.05
F-Ratio For Test Of Equality Of Mean Vectors	2 and 63		2.7769	<.0699

Figure B. Summary MANOVA Table: Main effects of treatment in the 2 x 2 factorial, Treatment X ACH.

TABLE VI

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Dependent Variable	df	Mean Square	Univariate F	Probability
Unit Test	1	17.0000	0.7814	<.38
Comprehensive Examination	1	8.4706	2.5388	<.12
F-Ratio For Test Of Equality Of Mean Vectors	2 and 63		2.4482 (Multivariate) F	<.0947

Figure A. Summary MANOVA Table: Main effects of Factor Q2 in the 2 x 2 factorial, Treatment X Factor Q2.

Dependent Variable	df	Mean Square	Univariate F	Probability
Unit Test	1	9.9412	0.4447	<.50
Comprehensive Examination	1	0.9412	0.2785	<.60
F-Ratio For Test Of Equality Of Mean Vectors	2 and 63		0.2674	<.7663

Figure B. Summary MANOVA Table: Main effects of ACH in the 2 x 2 factorial, Treatment X ACH.

TABLE VII

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Dependent Variable	df	Mean Square	Univariate F	Probability
Unit Test	1	80.5294	3.7015	$< .05$
Comprehensive Examination	1	0.0000	0.0000	< 1.00
F-Ratio For Test Of Equality Of Mean Vectors	2 and 63		2.0918 (Multivariate) F	$< .1320$

Figure A. Summary MANOVA Table: Interaction effects between Treatment and Factor Q2.

Dependent Variable	df	Mean Square	Univariate F	Probability
Unit Test	1	50.0460	2.2386	$< .10$
Comprehensive Examination	1	4.2943	1.2706	$< .26$
F-Ratio For Test Of Equality Of Mean Vectors	2 and 63		2.6324	$< .0799$

Figure B. Summary MANOVA Table: Interaction effects between Treatment and ACH.

TABLE VIII

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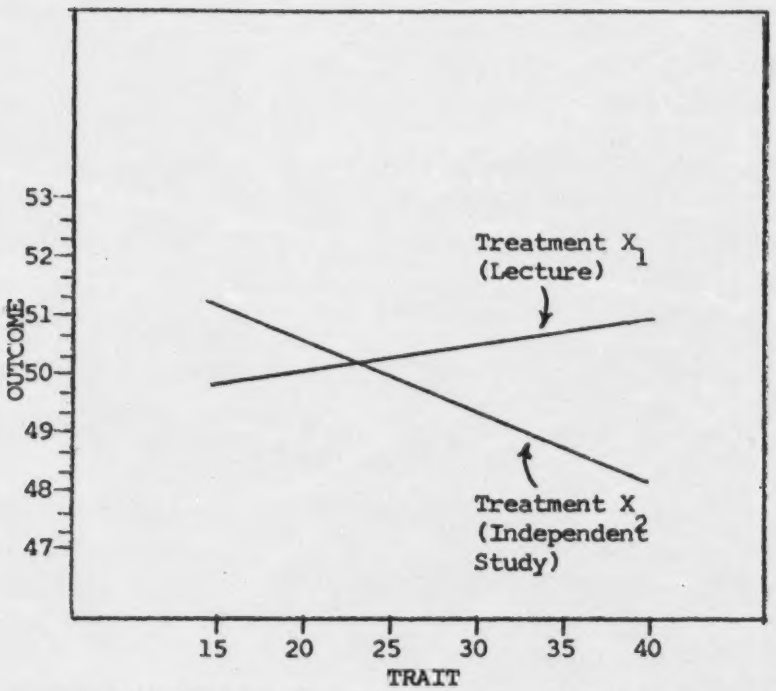

Figure A Significant disordinal interaction between treatment and Factor Q2 (group-dependency vs. self-sufficiency) on Unit Test Scores.

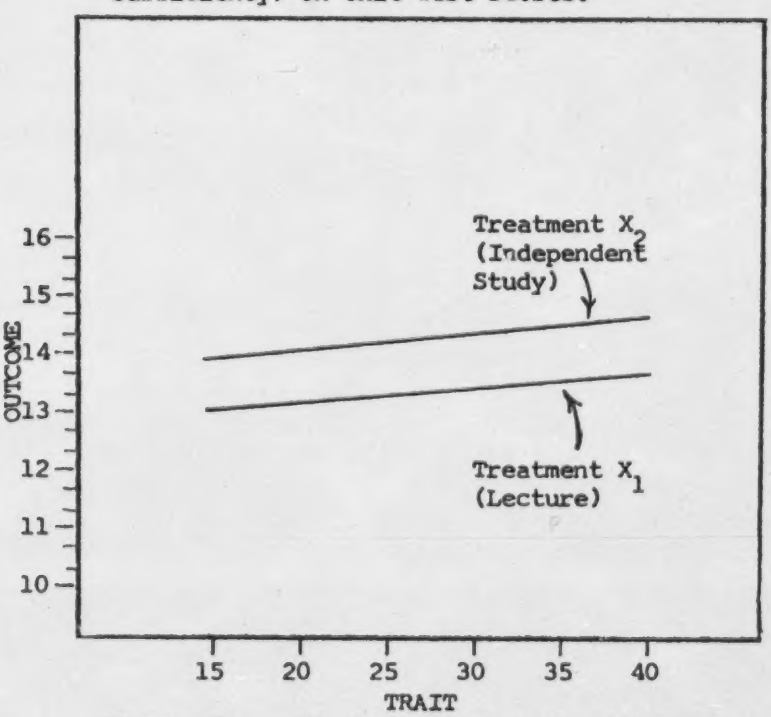

Figure B No interaction between treatment and Factor Q2 (group-dependency vs. self-sufficiency on Comprehensive Examination scores.

TABLE IX

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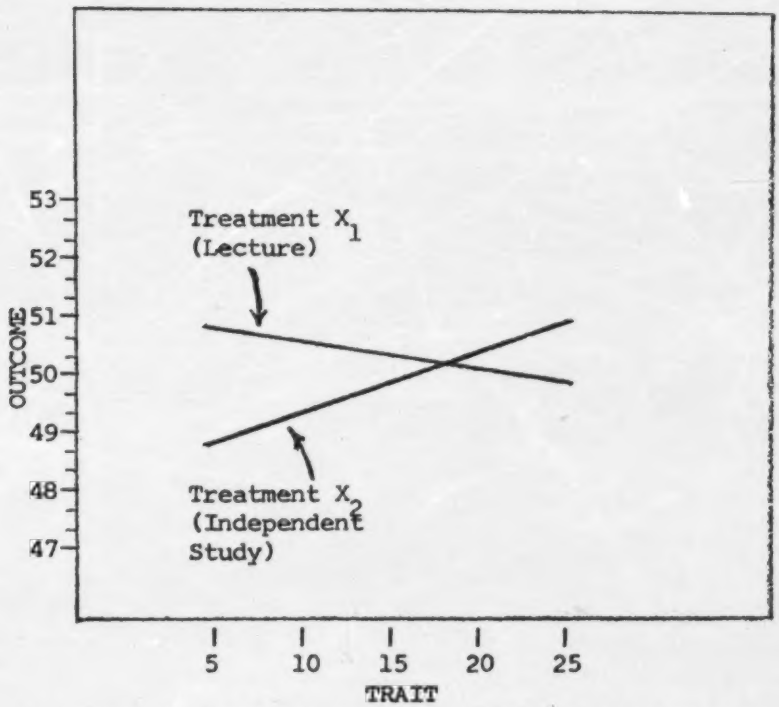

Figure A Nonsignificant disordinal interaction between treatment and need achievement (ACH) on Unit Test scores.

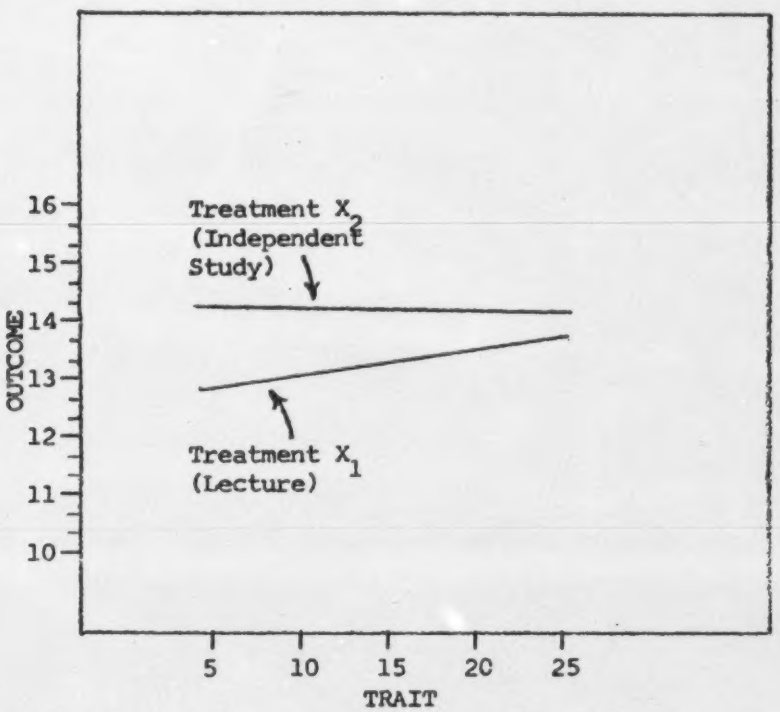

Figure B Nonsignificant ordinal interaction between treatment and need achievement (ACH) on Comprehensive Examination scores.

DISCUSSION

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A. General

1. Treatments (Instructional methods)

Students in the lecture method group and the independent study method group performed equally as well on the Unit Test. Performances on the Comprehensive Examination, however, were significantly better for independent study method students than for lecture method students. Actually, the Comprehensive Examination was not an accurate measure of retention for students of the independent study method group. The length of time between the Unit Test and the Comprehensive Examination was uniform (48 days) for lecture method students. However, the length of time between the Unit Test and the Comprehensive Examination for independent study method students was variable. 48 days, 38 days and 10 days intervened between the two performance measures. Superior performance on the Comprehensive Examination for these students could be explained on the basis of the lesser amount of time having elapsed between the Unit Test and the Comprehensive Examination coupled with the more recent familiarity of the subject matter. Such a variable testing schedule, however, is consistent with the philosophy of self-pacing and individualized testing in an independent study approach. It is also well to remember that the independent study method students had a more integrated instructional experience while viewing radiographic slides than did their lecture method counterparts. The former students were able to view slides under more favorable circumstances:

better projection, less distraction, capability of viewing any slide for any length of time, etc. These circumstances may have proved advantageous to the independent study method students since the Comprehensive Examination was composed exclusively of x-ray slide identifications. Due to significant differences in performance on the Comprehensive Examination, a trend toward differences in over-all performance was established, with the independent study method students performing somewhat better than the lecture method students. The differences, however, proved to be non-significant.

In terms of performance measures, the results of this study, like most reviewed in the literature, provide no real support for the generalized use of the independent study method of instruction.

2. Personality Variables (Factor Q2, ACH)

Self-sufficient and group-dependent students performed equally as well on the Unit Test. Self-sufficient students performed slightly better on the Comprehensive Examination, although not at a significant level. Group-dependent students performed slightly better over-all, although not at a significant level. High need achievers and low need achievers performed equally as well on both the Unit Test and the Comprehensive Examination, and on over-all performance.

3. Interaction Effects

Multidimensional relationships, such as the multivariate interactions in this study, are extremely difficult to illustrate. A trend toward selecting one of the two treat-

ments for a certain level of need achievement in order to produce maximum, over-all performance was demonstrated. This trend, however, was non-significant. No such trend was demonstrated between the treatments and levels of Factor Q2 on over-all performance. The two-dimensional or univariate interactions were easier to illustrate (Tables VIII and IX) and interpret, but in some cases, no less difficult to understand. The significant disordinal interaction of Figure VIIIA shows that self-sufficient students achieved higher scores on the Unit Test through the lecture method. Conversely, group-dependent students performed better in the independent study method. Students with an average degree of the trait performed about as well under either instructional method. Although there had been no significant main effects of either treatment or Factor Q2 on the Unit Test, the reverse interaction might be the one expected based on the Cattell and Stice (1957) description of the Factor Q2 polarities. If indeed self-sufficient students are "...more dissatisfied with group integration...", they might be expected to perform better under the independent study method. That they did not may attest to the truly assumptive nature of that relationship. The results may also reflect idiosyncrasies inherent in the Unit Test that are, as yet, unexplained. Figure VIIIBshows that no interaction whatsoever exists between the treatments and levels of Factor Q2 on Comprehensive Examination performance. Students in the independent study method group scored better on this performance measure at all levels of Factor Q2

than did their lecture method counterparts. These results, along with the significant main effects of treatment on the Comprehensive Examination, strongly suggest that the closely integrated experience of slide-tape learning was advantageous to the independent study method group in their achievement scores on an all-slide identification examination. Again, the variable time intervals between the Unit Test and the Comprehensive Examination for independent study method students may also be a contributing factor. Figure IXA reveals a non-significant disordinal interaction between treatments and need achievement on Unit Test scores. High need achievers performed slightly better in the independent study method group. Low need achievers performed slightly better in the lecture method group. Students with an average degree of the trait did about as well under either treatment. Figure IX B reveals a non-significant ordinal interaction between treatments and levels of need achievement on the Comprehensive Examination. Students in the independent study method group performed somewhat better at all levels of need achievement, although at high levels of the trait, the differences were very small.

B. Implications

Except for the ambiguous univariate interaction between treatments and Factor Q2 on the Unit Test, all interactions between the selected treatments and personality variable were non-significant. The combination of these instructional methods and personality variables did not influence achievement scores. Neither did the personality variables of group-dependency vs.

self-sufficiency and need achievement result in significant differences in achievement scores. If the trends toward significant multivariate interactions are any indication, future meaningful interactions might be obtained with these particular personality variables under different treatment conditions. It is quite possible that these variables will never provide meaningful interaction information under any circumstances. These trends do indicate, however, that significant and hopefully meaningful combinations of instructional methods and student personality variables could be discovered.

It was also demonstrated that students involved in independent study were able to achieve scores similar to more traditional methods while providing for self-paced study, and testing. In this manner, the dental curriculum can become more responsive to individual student needs.

SUMMARY

This study investigated possible interactions between instructional methods and student personality characteristics on achievement in dental radiology. After initial classification based on results of the Factor Q2 portion of the 16 Personality Factor Questionnaire, 17 group-dependent and 17 self-sufficient students were randomly assigned to both the lecture method and the independent study method of instruction. Later, a classification of high and low need achievers was also made based on results of need achievement portion of the Edwards Personality Preference Schedule. All subjects then completed the same interpretive dental radiology course under their assigned instructional methods. After completion of the course, three similar Unit Tests were administered at different times; the first was intended for lecture method students. Independent study method students had the opportunity to take any one of the three Unit Tests. At a later date, one Comprehensive Examination was administered to all subjects. Using MANOVA with 2 x 2 factorial designs, significant main effects for instructional methods on Comprehensive Examination scores were demonstrated. There were no significant main effects for personality variables. One univariate interaction between instructional methods and Factor Q2 on the Unit Test was demonstrated. All multivariate interactions were non-significant. Generally speaking, similar achievement in dental radiology appears to be possible using either instructional method for various levels of the two personality variables.

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APPENDIX

Factor 2Q (Self Sufficiency vs Group Dependency) from:
16 Personality Factor Questionnaire (16 PFQ)

1. In constructing something, I would rather work: (a) with a committee, (b) uncertain, (c) on my own.

2. As a teenager, I joined in school sports: (a) occasionally, (b) fairly often, (c) a great deal.

3. I prefer to marry someone who can: (a) keep the family interested in its own activities, (b) in between, (c) make the family a part of the social life of the neighborhood.

4. I would rather enjoy life quietly in my own way than be admired for my achievements: (a) true, (b) uncertain, (c) false.

5. At fifteen or sixteen I went about with the opposite sex: (a) a lot, (b) as much as most people, (c) less than most people.

6. I like to take an active part in social affairs, committee work, etc.: (a) yes, (b) in between, (c) no.

7. It bothers me if people think I am being too unconventional or odd: (a) a lot, (b) somewhat, (c) not at all.

8. Most people would be happier if they lived more with their fellows and did the same things as others: (a) yes, (b) in between, (c) no.

9. I like to do my planning alone, without interruptions and suggestions from others: (a) yes, (b) in between, (c) no.

10. I learn better by: (a) reading a well-written book, (b) in between, (c) joining a group discussion.

11. I find it easy to think out my own plans: (a) not usually, (b) usually, (c) always.

12. I have been elected to: (a) only a few offices, (b) several, (c) many offices.

13. My friends probably think it is hard to get to know me really well: (a) yes, (b) in between, (c) no.

14. I solve a problem better by: (a) studying it alone, (b) in between, (c) discussing it with others.

15. We should direct our lives more by: (a) the standards of our group, (b) in between, (c) our own individual reasoning.

16. Many people talk over their problems and ask advice of me when they need someone to talk to: (a) yes, (b) in between, (c) no.

17. A person whose ambitions hurt and damage a close friend may yet be considered an ordinary, decent citizen: (a) yes, (b) in between, (c) no.

18. When looking for a place in a strange city, I would: (a) just ask people where places are, (b) in between, (c) take a map with me.

19. When pushed and overworked, I suffer from indigestion or constipation: (a) occasionally, (b) hardly ever, (c) never.

20. I get as many ideas from reading a book myself as from discussing its topics with others: (a) yes, (b) in between, (c) no.

21. When I plan something, I like to do so quite alone, without any outside help: (a) yes, (b) occasionally, (c) no.

22. I feel it is cruel to vaccinate very small children, even against contagious diseases, and parents have a right to stop it: (a) yes, (b) in between, (c) no.

23. There are really more nice people than objectionable people in the world: (a) yes, (b) in between, (c) no.

24. I avoid getting involved in social responsibilities and organizations: (a) yes, (b) sometimes, (c) no.

25. I sometimes hesitate to use my own ideas, for fear they might be impractical: (a) yes, (b) in between, (c) no.

26. To vote well on a social issue, I would read: (a) a widely recommended novel about it, (b) in between, (c) a testbook listing statistical and other facts.

APPENDIX

Need Achievement (ACH) from:
Edwards Personality Preference Schedule (EPPS)

1. I like to do my very best in whatever I undertake.
2. I would like to be a recognized authority in some job, profession, or field of specialization.
3. I would like to tell amusing stories and jokes at parties.
4. I like to be able to come and go as I want to.
5. I like to solve puzzles and problems that other people have difficulty with.
6. I would like to be a recognized authority in some job, profession, or field of specialization.
7. I like to accomplish tasks that others recognize as requiring skill and effort.
8. I like to be successful in things undertaken.
9. I like to solve puzzles and problems that other people have difficulty with.
10. I like to accomplish tasks that others recognize as requiring skill and effort.
11. I would like to write a great novel or play.
12. I would like to be a recognized authority in some job, profession or field.
13. I like to do my very best in whatever I undertake.
14. I like to be able to do things better than other people can.
15. I like to be able to say that I have done a difficult job well.
16. I would like to accomplish something of great significance.

17. I would like to write a great novel or play.

18. I like to do my very best in whatever I undertake.

19. I like to be able to say that I have done a difficult job well.

20. I like to be successful in things undertaken.

21. I like to be able to do things better than other people can.

22. I like to solve puzzles and problems that other people have difficulty with.

23. I like to do my very best in whatever I undertake.

24. I like to accomplish tasks that others recognize as requiring skill and effort.

25. I would like to accomplish something of great significance.

26. I like to be successful in things undertaken.

27. I would like to write a great novel or play.

APPENDIX

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WINTER TERM CURRICULUM (1973)
INTERPRETIVE DENTAL RADIOLOGY
SCHOOL OF DENTAL MEDICINE
UNIVERSITY OF PITTSBURGH

2/13/73 - Lecture #7 - INTERPRETATION OF CYSTS OF ODONTOGENIC ORIGIN

DR. WILLARD FISCHER

"At the bottom of the mimeographed page that you will have in your hands in a moment, we hope will be the end result of our presentation this afternoon. But I'd like to go about it in this way. I think the end product of all our knowledge is the ability to advise a patient. So I think we can talk about cysts of odontogenic origin in clinical terms, that is to say what goes through the dentist's mind when he notices something suspicious on a radiograph as to whether or not it may or may not be a cyst and whether it be of odontogenic origin or not.

You know we have emphasized so far the need for thorough examination of the patient and of the radiographs, all sizes of things. On the front of the film in the view box, you won't see underneath it or on the other side, so it really doesn't make any difference whether or not we examine the film from one side to the other. But the observance of the dot on the film if we place it properly in the mouth, whether or not we look at it from one side to the other, will help us record the findings on the examination form and help us mount the films. It doesn't make any difference whether we examine from one side or the other.

Now to get down to brass tacks and put it into clinical terms, let me present to you a few of the common problems that the clinician is faced with in his decision as to what a lesion is or whether it is a lesion and perhaps a little bit about what he might do about it. First of all let me present to you (points to x-ray slide on screen) the radiographs, the case, the patient that was referred by dentist with this question in mind: "Doctor, I've seen the patient and the patient needs a new crown and tooth". The old crown is defective for one reason or another. Perhaps, clinically, it has a space between the tooth and the crown - a leaky margin in other words. Perhaps the shade of the crown is no longer acceptable. So our dentist wants to know whether or not it is safe for him to remake a crown on this tooth when he sees the radiolucency appear and he wants to know what this radiopacity is here as an aside.

Now what does one think about? Well, most of the serious pathology and most of the more benign kinds of pathology that are evident on the radiograph are evident in the form of a radiolucency, which means a darkness..."

APPENDIX

WINTER TERM CURRICULUM (1973)
INTERPRETIVE DENTAL RADIOLOGY
SCHOOL OF DENTAL MEDICINE
UNIVERSITY OF PITTSBURGH

(GIVEN TO LECTURE METHOD GROUP
WITHOUT HEADING "UNIT I")

UNIT I ANOMALIES--Developmental
(Tooth number, position,
size and shape)

OBJECTIVES

1. Definitions--

a. anomaly
b. developmental anomaly
c. anodontia
d. oligodontia
e. supernumerary
f. mesiodens
g. transposition
h. primary fusion
i. secondary
j. gemination
k. microdontia
l. macrodontia
m. megadontia
n. megalodontia
o. taurodontia
p. dilaceration
q. Hutchinson's teeth

2. Relationships--

a. The student can explain how certain developmental anomalies of tooth number, position, size and shape can act as predisposing factors to pathological conditions in the oral cavity.

b. The student can describe what relationship exists between some anomalous conditions of tooth number, position, size and shape and certain developmental disturbances of the body as a whole.

c. The student can state the potential problems in dental treatment that can be caused by certain anomalous conditions of tooth number, position, size and shape.

3. Identifications--

When presented with radiographic slides containing one or more of the following anomalies, the student can identify:

a. oligodontia
b. supernumerary teeth
c. mesiodens
d. transposition
e. retarded growth
f. primary fusion
g. secondary fusion
h. microdontia
i. macrodontia
j. taurodontia
k. dilaceration
l. accessory roots
m. accessory pulp canals
n. Hutchinson's teeth

APPENDIX

WINTER TERM CURRICULUM (1973)
INTERPRETIVE DENTAL RADIOLOGY
SCHOOL OF DENTAL MEDICINE
UNIVERSITY OF PITTSBURGH

1/9/73.....Anomalies-Developmental (Dr. D. Mazzocco)

1/16/73.....Anomalies-Developmental (Dr. D. Mazzocco)

1/23/73.....Anomalies-Acquired (Dr. W. Fischer)

1/25/73.....Interpretation of Apical Lesions (Dr. D. Mazzocco)

1/30/73.....Osseous Abnormalities (Dr. D. Mazzocco)

2/6/73.....Interpretation of Cysts of Odontogenic Origin (Dr. D. Mazzocco)

2/13/73.....Interpretation of Cysts of Odontogenic Origin (Dr. W. Fischer)

2/20/73.....Interpretation of Cysts of Nonodontogenic Origin (Dr. D. Mazzocco)

2/27/73.....Interpretation of Cysts of Nonodontogenic Origin (Dr. W. Fischer)

3/6/73.....Interpretation of Periodontal Disease (Dr. D. Mazzocco)

3/13/73.....General Review (Dr. D. Mazzocco)

UNIT III

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Self-Evaluation Quiz

Do not write either your name or code number on this quiz sheet. The quiz is not being graded by the Radiology Department.

Take this quiz without using a textbook or written notes.

Before you go on to UNIT IV, take this self-evaluation quiz. After taking the quiz, you should be better able to evaluate your own progress over this unit of instruction.

Please complete the entire quiz within 15 minutes.

After you have completed the quiz, request an answer key, grade your own test and record the grade. If you answered less than 7 out of 8 questions correctly for Part 1, you should review the material pertaining to the question(s) you missed. Review also if you answered any of the six questions incorrectly for Part 2.

After you have finished, return the self-evaluation quiz, the answer key, the slides and the tape to the learning lab office.

PART 1

Circle the correct answer.

1. The term that refers to teeth joined by cementum only is:

   a. condensing osteitis
   b. concrescence
   c. cementoma
   d. calculus

2. A condition in which complications may be expected in tooth removal is:

   a. attrition
   b. pulpal obliteration
   c. hypercementosis
   d. all of the above
   e. none of the above

3. A common cause of cervical abrasion of teeth is:

   a. excessive brushing
   b. excessive grinding
   c. excessive tilting
   d. all of the above

4. Pulpal obliteration can be caused by:

   a. dilaceration
   b. attrition
   c. rarefaction
   d. transposition

5. Root resorption is caused by:

   a. inflammation
   b. dental treatment
   c. tooth eruption
   d. trauma
   e. all of the above

6. "Gingival burnout" refers to a radiographic radiolucency that occurs due to a/an:

   a. erosive effects of decay around the necks of teeth

   b. peripheral idiopathic resorption

   c. projection effect of X-rays

   d. therapeutic irradiation treatment

7. Death of the pulp may occur as a result of:

   1. internal resorption
   2. external resorption
   3. dilaceration
   4. attrition
   5. transposition

   a. 1,2 and 4

   b. 1,2 and 5

   c. 3,4 and 5

8. Hypercementosis is <u>most</u> often associated with which of the following conditions:

   a. dentinal dysplasia

   b. Letterer-Siwe Disease

   c. ectodermal dysplasia

   d. Paget's Disease

PART 2

Project and identify the anomalies contained within the following six (6) slides. Write your answers in the blanks provided.

#24: Identify the structure indicated by the arrow.

_____

#25: Identify the acquired anomaly affecting these maxillary incisors.

_____

#26: Disregarding caries and bone loss, identify the acquired anomaly associated with the maxillary lateral incisor.

_____

#27: Identify the acquired anomaly affecting these mandibular molars.

_____

#28: Disregarding bone loss and pulpal obliteration, identify the acquired anomaly affecting these mandibular incisors.

_____

#29: Identify the acquired anomaly affecting the mandibular bicuspid.

_____

APPENDIX

UNIVERSITY OF PITTSBURGH

SCHOOL OF DENTAL MEDICINE

FIRST YEAR CLASS

FIRST UNIT TEST

INTERPRETIVE DENTAL RADIOLOGY

APRIL 6, 1973

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1. An apical radiolucency associated with a maxillary right central incisor is seen on a radiograph. An intact lamina dura is also observed. The tooth responds positively to vitality testing. Additional clinical signs or symptoms are not present. The most probable explanation for the radiolucency is a/an:

   A. systemic infection
   B. occlusal trauma
   C. film artifact
   D. normal anatomical landmark

2. When an infected primary tooth causes defective enamel in an erupting permanent tooth, the permanent tooth is called a:

   A. Turner's Tooth
   B. supernumerary tooth
   C. Hutchinson s Tooth
   D. pink tooth

3. The periodontal ligament space or membrane that surrounds a normal tooth appears radiographically as a/an:

   A. unbroken, radiopaque line around the tooth root
   B. radiolucent line around the apical portion of the root only
   C. unbroken, radiolucent line around the tooth root
   D. radiopaque line on the lateral sides of the root only

4. Between what two teeth is a mesiodens located:

   A. maxillary central incisors
   B. mandibular bicuspids
   C. mandibular molars
   D. maxillary bicuspids

5. The type of periapical pathosis can be definitely diagnosed through:

      1. electrical vitality testing
      2. radiographic examination
      3. clinical examination
      4. histologic examination

   A. 2 only
   B. 4 only
   C. 1 and 3
   D. 2 and 3

6. The condition in which teeth are fused by cementum only is known as:

   A. cementum hyperplasia
   B. gemination
   C. concrescence
   D. cementoma

7. A major radiographic feature of ectodermal dysplasia is many:

   A. supernumerary teeth
   B. congenitally missing teeth
   C. pulpally obliterated teeth
   D. geminated teeth

8. Teeth that show periapical radiolucencies, pulpal obliteration and horizontal radiolucent lines are said to be affected by an abnormality known as:

   A. atubular dentin
   B. enamel hypocalcification
   C. amelogenesis imperfecta
   D. dentinal dysplasia

9. Problems in extraction may result if teeth show:

   A. accessory roots
   B. accessory pulp canals
   C. abnormally large pulps
   D. all of the above
   E. none of the above

10. Which of the following abnormalities appears as a radiographic radiopacity:

   A. chronic rarefying osteitis
   B. condensing osteitis
   C. Stage I cementoma
   D. acute dentoalveolar abcess
   E. solitary bone cavity

11. It is possible to make a differential radiographic diagnosis between a dental granuloma and a dental root cyst on the basis of:

   1. degree of radiolucency
   2. shape
   3. demarcation
   4. encapsulation
   5. none of the above

   A. 1 only
   B. 2 and 3
   C. 3 and 4
   D. 5 only

12. An anomaly affecting the dental pulp is:

   A. dilaceration
   B. taurodontia
   C. anodontia
   D. concrescence

13. A 25 year old woman presents with a painful palatal swelling. Upon examination, a soft, fluctuant, tender mass is found in the midline of the hard palate. All teeth respond positively to vitality testing and are free of periodontal disease. A well-defined radiolucency is seen on radiographs between the roots of the maxillary central incisors. Which of the following cysts is most suggested by the clinical and radiographic findings:

A. nasopalatine
B. nasolabial
C. apical radicular
D. dentigerous

14. A mandibular left second molar with filled root canals has a widened periodontal ligament space at the apex of the distal root. There are also dense, diffuse radiopacities at both apices. Of the following conditions, which is the most suspect:

A. ameloblastoma
B. chronic rarefying osteitis
C. condensing osteitis
D. odontoma

15. Of the following conditions, which appears radiographically as a radiolucency:

A. Stage I cementoma
B. Stage III cementoma
C. torus mandibularis
D. enostosis
E. condensing osteitis

16. Disarrangement of the enamel organ producing an enamel-lined invagination within the tooth is represented by what anomaly:

A. taurodontia
B. microdontia
C. enamel agenesis
D. internal resorption
E. none of the above

17. A diagnosis of periapical lesion is attributed most often to which of the following anatomical structures:

1. mental ridge
2. mental foramen
3. mylohyoid ridge
4. maxillary sinus
5. nasopalatine foramen

A. 1, 3, and 5
B. 1, 4, and 5
C. 2, 4, and 5

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18. As a developmental union of two or more teeth, fusion is characterized by:

    A. union of dentin and one other dental tissue
    B. union by cementum
    C. union of pulps only
    D. ankylosis of teeth to bone

19. An occlusal radiograph of a patient's maxillary arch reveals a radiolucency between the roots of the right lateral incisor and canine. The roots of both teeth show some divergence. The vitality of both teeth is within normal limits. The radiolucency is most suggestive of what cyst:

    A. nasopalatine
    B. globulomaxillary
    C. apical radicular
    D. dentigerous

20. The best description of a dentigerous cyst is a tooth:

    A. crown inside a radiolucency
    B. root inside a radiolucency
    C. crown and root inside a radiolucency
    D. separated from a radiolucency

Name BEST COPY AVAILABLE No. ____

This part of the examination is composed of forty (40) slide identifications. A brief description is given for each slide that is to be projected. All of the slides represent an anomaly, abnormality or pathological entity. Write your answers in the blanks provided.

1. Clinical examination reveals symmetrical protuberances on the lingual surface of the anterior portion of the mandible. They correspond to the bilateral radiopacities on the film. Identify them.

_____

2. Identify the anomaly affecting the pulps and roots of the mandibular first and second molars.

_____

3. Identify this anomaly of tooth structure that may be familial.

_____

4. Identify the anomaly associated with these teeth.

_____

5. Identify the radiolucency distal to the mandibular second molar. There is no indication of a third molar or supernumerary tooth present on that side, and the lamina dura of the second molar is intact.

_____

6. Identify the vertical radiopaque structure indicated by the arrow.

_____

7. Identify the abnormality associated with the maxillary incisors.

_____

8. Identify the anomaly associated with these mandibular teeth.

_____

9. All teeth present respond positively to vitality testing. Lamina durae are intact throughout. Identify the radiolucency.

_____

10. Identify the abnormality represented by the oval radiolucency seen within the maxillary lateral incisor.

_____

11. Identify the radiopaque abnormality of bone that surrounds the periapically involved mandibular molar.

_____

12. The patient recalls being hit by a baseball on this side of the mandible. All teeth are within normal vitality limits and lamina durae are intact. Identify the horizontal radiolucency.

_____

13. Identify the rounded radiopacity indicated by the arrow.

_____

14. Identify the combined radiolucency-radiopacity associated with the apex of the mandibular cuspid.

_____

15. Identify the radiopaque structures between the maxillary permanent central incisors indicated by the arrows.

_____

16. Identify the tooth anomaly.

_____

17. Identify the tooth anomaly.

_____

18. Identify the radiolucency associated with the non-vital maxillary lateral incisor.

_____

19. Identify the anomaly associated with these teeth.

_____

20. Identify the anomaly associated with the maxillary first and second molars.

_____

21. All maxillary anterior teeth were found to be vital and with intact lamina durae. Clinically, a slight swelling was noticed behind the palatine papilla. Identify the radiolucency associated with the maxillary anterior teeth.

_____

22. Identify the tooth anomaly.

_____

23. Disregarding the periapical radiolucency, identify the anomaly associated with the maxillary lateral incisor.

_____

24. Disregarding dilaceration, identify the abnormality associated with the root of the endodontically treated tooth.

_____

25. Identify the radiolucency associated with a recently removed maxillary lateral incisor.

_____

26. Identify the anomaly associated with the maxillary bicuspid to the left.

_____

27. Disregarding bone loss, identify the abnormality associated with the maxillary central incisors.

_____

28. Identify the tooth anomaly.

_____

29. Identify the radiolucency associated with the erupting maxillary permanent central incisor to the right.

_____

30. Identify the anomaly associated with the root of the endodontically treated mandibular central incisor.

_____

31. Vitality of the maxillary central incisors is within normal limits and lamina durae are intact. Identify the radiolucency between the maxillary central incisors.

_____

32. Disregarding bone loss, identify the abnormality associated with these mandibular incisors.

_____

33. Identify the radiolucency associated with the non-vital maxillary lateral incisor.

_____

34. Identify the abnormality associated with the maxillary anterior teeth.

_____

35. All teeth respond positively to vitality testing. Lamina durae are intact throughout. Identify the radiolucency.

_____

36. Identify the anomaly associated with the maxillary lateral incisor.

_____

37. Identify the radiolucency associated with the unerupted mandibular third molar.

_____

38. Identify the anomaly associated with the tooth indicated by the arrow.

_____

39. Identify the radiolucency associated with the impacted mandibular bicuspid.

_____

40. Disregarding the radiolucency, identify the anomaly associated with the mandibular third molar.

_____

APPENDIX

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UNIT TEST PERIODS
WINTER TERM CURRICULUM (1973)
INTERPRETIVE DENTAL RADIOLOGY
SCHOOL OF DENTAL MEDICINE
UNIVERSITY OF PITTSBURGH

TEST PERIOD FOR ALL LECTURE STUDENTS

Period I (April 6, 1973)

† Allison, Owen W.
Arbit, Scott P.
† Arendt, Paul H.
Arnold, Gregory V.
Bender, Barrett M.
† Brendel, Timothy J.
Briesch, Josiah E., Jr.
Brindock, Thomas N.
Brotemarkle, Martin L., Jr.
Brown, David F.
• Brummitt, Gregory E.
• Bucci, Guy, Jr.
Cade, Ronald E.
† Cafrelli, Robert A.
† Cameron, William A.
† Carberry, Debra L.
† Carlough, Kenneth S.
Cato, Rlaph J.
Choby, William A.
† Ciao, William L.
Clark, Vincent J.
Coleman, Donald B.
Dears, Daniel R.
DeForno, Richard E.
† DeNardo, Kenneth C.
• Dengel, Edward J.
Duryea, David J.
Earley, Samuel L.
† Eisner, Jeffrey M.
Estok, John E.
Federici, Joseph R.
Frank, Richard J.
George, Jerome W.
Graham, William D. III
Gray, Richard H.
† Grosser, I. Scott
Haag, Raymond J.
† Hatchner, Carl B.
† Head, Michael D.
Henteleff, Harvey B.
† Hicks, Eric V.
Hinsley, William E., Jr.
† Hooper, Jeffrey P.
† Jordan, Steven J.
Jumber, Michael J.
Kerfonta, Vincent R.
Kerna, Paul D.
Kimberlin, Gary L.
Kramer, Michael I.
Krymowski, David V.
† Kukucka, Stephen P.
Kuniak, Stephen A.
Lasco, George A.
Logan, James R.
† Lowy, M. Alexander
† Luther, Robert, Jr.
McCabe, Charles T., Jr.
McClain, Richard P.
† McClure, Stephen K.
Mahoney, Philip M.
† Mangin, John A.
Matthews, Robert
† Maximiek, William
† Metz, Richard B.
Miller, Heather J.
Moore, James C.
Morgan, Edward R.
Morris, Theodore M.
Noel, Kenneth A.
† O'Hara, Dennis B.
Parrisse, Kathleen A.
† Patterson, Anthony R., Jr.
Perry, Dennis A.
• Piper, James M.
Reilly, Terrence J.
Relis, Benjamin I.
† Rice, Jeffrey W.
† Robbins, James S.
Rosato, Robert J.
† Ross, Rodney B.
Runatz, Michael C.
Rutkowski, James L.
Sabo, William M.
Sax, Alexander D.
Schlemmer, Edwin R.
Shipper, David M.
Shutty, Walter F.
Sklencar, Ronald J.
† Sloss, Robert J.
• Stachowicz, David H.
Stein, Barry R.
Sunukjian, James R.
† Wawrzeniak, Joseph J.
† Wertz, David M.
Wheeler, James R.
•• Wilcko, James M.
† Williams, Ben G.
† Wilson, David G.
† Zeitler, Joseph P.
Zilker, David C.

• Denotes independent study method student
•• Denotes student did not take examination
† Denotes lecture method student

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INDEPENDENT STUDY METHOD GROUP

Period II (April 16, 1973)

Andrews, Deborah J.
††Bayley, Robert T. III
Beall, John A.
Bergen, Eugene D., Jr.
Caldwell, Kenneth L.
††Fenimore, Dario A.
Finnessy, John J.
Giovannitti, David P.
Golaszewski, Janet A.
Gottlieb, Richard L.
Hampe, Jill M.
Jakenta, George T.
Jones, Ronald R.
McGuire, David W.
Matika, Gregory F.
Notarius, Harvey J.
Paulhamus, Ronald S.
Rapetti, Paul E.
Whalen, Robert J., Jr.
Williams, Andrew M.
Winter, Raymond G.

Period III (May 14, 1973)

Bailey, Terry M.
Benz, Jeffrey T.
Bowman, John M.
DiSantis, Edward J.
Donatelli, Herman A.
Katz, Jerald O.
Pfeffer, Joseph R., Jr.
Simon, Robert L.
Sobran, John
††Stark, David J.
Wells, William F.

†† Denotes lecture student

APPENDIX

UNIVERSITY OF PITTSBURGH

SCHOOL OF DENTAL MEDICINE

FIRST YEAR CLASS

COMPREHENSIVE EXAM

INTERPRETIVE DENTAL RADIOLOGY SECTION

MAY 24, 1973

This part of the examination consists of twenty (20) multiple choice slide identifications. All of the slides represent an anomaly abnormality or pathological entity.

44. Without any additional information, the large radiolucency represents a/an:

    1. dentigerous cyst.
    2. radicular cyst.
    3. residual cyst.
    4. traumatic bone cyst.

    A. 2 only
    B. 3 only
    C. 4 only
    D. 1 or 4
    E. 2 or 4

45. The anomaly represented here is

    A. macrodontia.
    B. dentinogenesis imperfecta.
    C. taurodontia.
    D. dentinal dysplasia.

46. The abnormality seen here is a

    A. double root.
    B. dilacerated root.
    C. retained root.
    D. resorbed root.

47. The structure indicated by the arrow most probably represents a/an

    A. Stage II cementoma.
    B. residual cyst.
    C. lateral periodontal cyst.
    D. supernumerary tooth.

48. The anomaly seen here is one of

    A. accessory roots.
    B. accessory pulp canals.
    C. root resorption.
    D. taurodontism.

49. Without any additional information, the radiolucency most probably represents a/an

1. anatomical landmark.
2. cementoma.
3. radicular cyst.
4. traumatic bone cyst.

A. 1 only
B. 2 only
C. 3 only
D. 2 or 3
E. 2 or 4

50. The structure indicated by the arrow is a/an

A. exostosis.
B. mesiodens.
C. incisive canal cyst.
D. none of the above.

51. The abnormality associated with the maxillary lateral incisor is most probably

A. enamel hypoplasia.
B. external resorption.
C. dens in dente.
D. internal resorption.

52. The anomaly represented here is

A. external resorption.
B. ectodermal dysplasia.
C. periodontitis.
D. dentinal dysplasia.
E. microdontia.

53. The abnormality of bone represented here is most probably

1. osteomyelitis.
2. condensing osteitis.
3. rarefying osteitis.
4. osteosclerosis.

A. 1 only
B. 4 only
C. 1 or 4
D. 3 or 4
E. 1, 2, or 4

54. The anomaly associated with the mandibular cuspid is

A. hypercementosis.
B. transposition.
C. macrodontia.
D. abrasion.

55. The anomaly seen here is

A. fusion.
B. internal resorption.
C. pulp calcification.
D. pulp obliteration.

56. The radiolucency is most probably a

1. residual cyst.
2. radicular cyst.
3. primordial cyst.
4. cementoma.

A. 1, 2, or 3
B. 1 or 2
C. 2, 3, or 4
D. 3 or 4

57. The abnormality represented here is

A. enamel hypoplasia.
B. external resorption.
C. dens in dente.
D. internal resorption.

58. The anomaly seen here is

A. oligodontia.
B. microdontia.
C. transposition.
D. taurodontia.

59. Without any additional information, the large radiolucency is most probably a/an

1. anatomical landmark.
2. incisive canal cyst.
3. radicular cyst.

A. 1 only
B. 2 only
C. 3 only
D. 1, 2, or 3

60. The structure indicated by the arrow is most probably a/an

A. retained root.
B. unerupted tooth.
C. osteosclerosis.
D. enostosis.

61. The tooth indicated by the arrow is an example of

A. pulp calcification.
B. internal resorption.
C. dens in dente.
D. fusion.

62. The lesion indicated by the arrow represents a/an

A. cementoma.
B. granuloma.
C. radicular cyst.
D. hypercementosis.
E. none of the above.

63. Assuming the tooth to be vital, the radiolucency associated with the maxillary central incisor to the right is <u>most</u> probably a/an

1. acute rarefying osteitis.
2. granuloma.
3. radicular cyst.
4. anatomical landmark.

A. 1 or 2
B. 1 or 4
C. 2 or 4
D. 3 or 4